

## The Knowledge Bank at The Ohio State University

### Ohio State Engineer

**Title:** Cement Manufacture in Ohio

**Creators:** Layton, John William

**Issue Date:** Apr-1931

**Publisher:** Ohio State University, College of Engineering

**Citation:** Ohio State Engineer, vol. 14, no. 6 (April, 1931), 4-5, 18.

**URI:** <http://hdl.handle.net/1811/34783>

**Appears in Collections:** [Ohio State Engineer: Volume 14, no. 6 \(April, 1931\)](#)

# CEMENT MANUFACTURE IN OHIO

By J. WILLIAM LAYTON, E. E. 3

Recently I was accorded the pleasure of a trip through the Osborn plant of the Wabash Portland Cement Company. It is located three miles east of Osborn, or twelve miles east of Dayton, Ohio, on State Route 4, which passes between the quarry and the plant. The plant is located at one of the best finds of cement rock in the state of Ohio.

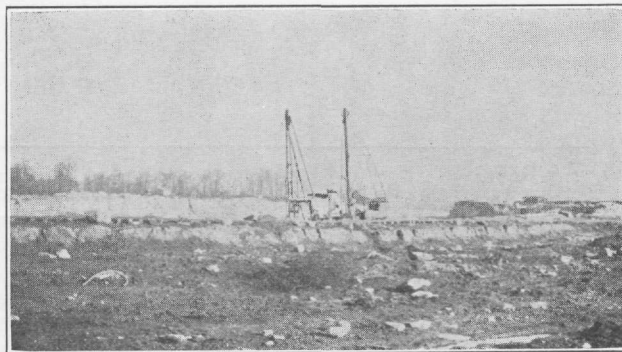
The main constituents of cement are clay and limestone which are mixed in the ratio of one part clay to five parts limestone subject to slight variations. The rock used in making cement must be very high in lime and low in magnesium content. The clay used must also fill rigid chemical requirements.

The clay used at this plant is obtained by stripping the topsoil from the rock. The clay not fit for use in the manufacture of cement is used for fills and grading purposes about the plant grounds. One of the illustrations shows a steam shovel engaged in stripping the topsoil from the rock and loading it into cars preparatory to hauling it to the plant.

The drills located in the foreground of the photograph are used for drilling holes in the rock. After several of these holes are drilled ten to fifteen feet back from the edge of the quarry, they are charged with dynamite and exploded as a single charge. This causes a section of rock ten to fifteen feet wide and many feet long to break loose and drop to the quarry floor below. Here it is loaded into dump cars for transportation to the plant. The portions of rock too large to be handled by the 5½-ton steam shovel are further broken up by light charges of dynamite. The depth to which the rock can be quarried is about 40 feet as the percentage of magnesium in the rock below this point is high enough to cause the rock to be unfit for the manufacture of cement.

From the quarry the rock is transported to the small building at the extreme left of the plant. A set of six cars can be seen on the siding waiting to be unloaded. Under the floor of the building is located a large rock crusher capable of reducing the largest incoming rock fragments to pieces only three and one-half inches in diameter. The cars are dumped one at a time directly into the top of the crusher.

The crusher consists of a large rotating part



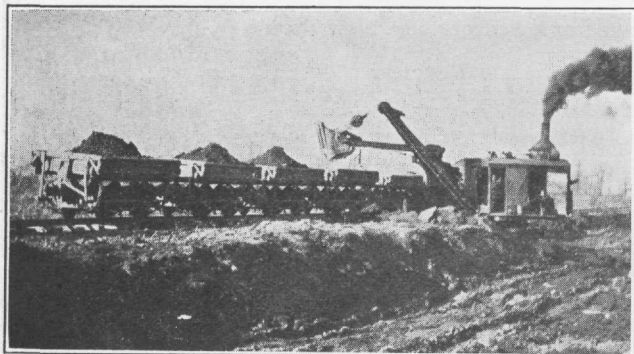
Stripped Ground, Drills, and Quarry

formed in the shape of an inverted cone and a heavy outer shell. The conical part crushes the rock between itself and the outer shell, moving with a rotary and eccentric motion. The rock entering the top of the crusher is broken up and falls down along the sides of the crusher where it is again crushed. This process is repeated until the remaining pieces fall from the bottom of the crusher on to the conveyor. The conveyor takes the rock to a hammer mill where it is further reduced in size. After passing through the hammer mill the pieces of rock are only 1¼ inches in diameter.

The clay is transported from the point of stripping operations to the plant. Here it is thoroughly mixed with water and all the small stones and other impurities washed out. It is then stored in liquid form in large bins or silos. Before the particles of stone from the hammer mill enter the third stage for further reduction in size the proper amount of clay is added.

The third stage is a compeb mill which reduces the rock and clay to such fineness that 98 per cent will pass through a 100-mesh screen, which has 10,000 squares to the square inch. The compeb mill is a large hollow horizontal cylinder divided into three compartments. Each compartment is partially filled with steel balls. These steel balls vary in size from 3½ inches in diameter in the first compartment to 7/8-inch in diameter in the third compartment. The entire mill rotates about its longitudinal axis being driven by a 500 h.p. motor. As the mill rotates the steel balls roll on the inner surface of the cylinder crushing the particles of stone and clay into a very fine powder. A constant stream of water washes the material from one compartment to the next. The mixture of clay and stone leaves the third compartment as a thick gray liquid. This mixture of water, clay and stone is known as a slurry. Several bins or silos are provided for storing the slurry.

Cement is formed by burning the slurry in a kiln. A rotary kiln 175' long and 11' 3" in diameter is used for this purpose. The slurry enters the low temperature end of the kiln as a liquid. During its passage through to the high temperature end it is dried and burned into a clinker. The kilns are fired with powdered coal. The temperature at the high temperature end of the kiln



Stripping Top Soil from Rock

is approximately 2800 degrees F. The temperature drops steadily throughout the length of the kiln until the temperature at the low temperature end varies from 1600 to 1000 degrees F. The temperature at the furnace end of the kiln is above the range for any commercial pyrometer. Therefore temperature readings are taken at the low temperature end of the kiln. Because of the high temperature encountered the six-inch firebrick lining of the kilns must be replaced at intervals of three to four months.

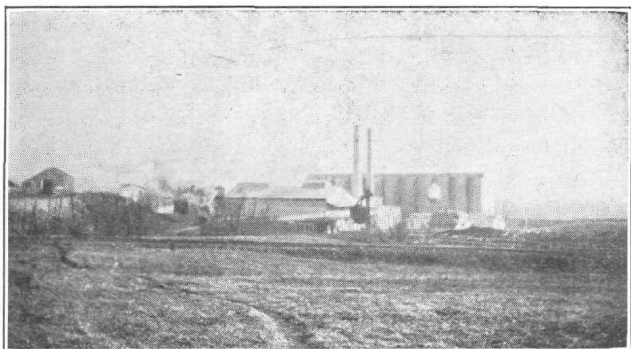
When the clinker reaches the furnace end of the kiln it drops down into a rotary cooler. The clinker arrives at the cool end of the rotary cooler as a small black particle varying from one-half inch to one inch in diameter. A chain conveyor receives the clinker and carries it off to a compeb mill to be ground into cement. As it starts out on this journey a spray of water finishes cooling it to normal temperature. At the entrance to the hopper of the compeb mill small quantities of gypsum are added. Gypsum is the ingredient of cement which determines the length of time required for the mixture of gravel, cement and water to set or harden. The less gypsum contained, the quicker the mixture will attain a permanent set. The amount of gypsum added varies from 2 to 3 per cent depending upon its quality and the type of construction in which the cement is to be used.

The cement leaves this compeb mill as a fine dry powder. A set of conveyors takes the cement from the compeb mill to a separator located above the compeb mill. The particles of cement leaving the compeb mill are not all of equal fineness. The separator removes the coarse particles and returns them to the compeb mill to be reground.

The separator is built similar to a large upright funnel. The cement from the conveyor enters the separator at the top and falls on to a rotating disk located near the top of the separator. This disk throws the cement particles out toward the edge of the separator where they are caught in an upward blast of air. The fine particles are carried up and out the top of the separator. Those particles too heavy to be supported by the blast of air fall to the bottom of the separator and are returned to the compeb mill. The degree of fineness of the finished cement can be regulated by changing the velocity of the blast of air through the separator.

The finished cement leaving the top of the separator is carried off to the next building by the same current of air which removed it from the separator. Here it may go to either of two places.

(Continued on Page 18)



Main Plant, Storage Bins in Background

## CEMENT MANUFACTURE IN OHIO

(Continued from Page 5)

First it may go to the sacking department where it is sacked and loaded into box cars preparatory to shipment. Second, if there are no immediate orders to be filled the cement is stored in the large bins provided for that purpose. The plant has 22 bins or silos with a storage capacity of 376,000 barrels of cement. These storage bins can be seen in the background of the illustration.

The plant has an output of 5,600 barrels of cement per lay. During the year 1930, the plant used 250,000 tons of rock mined with the help of 85,000 pounds of dynamite. Added to this was the 50,000 tons of clay necessary to keep up the ratio of one part clay to every five of rock. To burn all this in the kilns required the heat content of 80,000 tons of coal.

---